A COMPARATIVE STUDY OF LEXICAL TEAMING IN NORMALS AND APHASICS

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Reg. No. MSHM0110

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JUNE-2003

What you resist ...persists!

Certificate

This is to certify that this dissertation entitled **"A COMPARATIVE STUDY OF LEXICAL TRAINING IN NORMALS AND APHASICS"** is a bonafide work in part of fulfillment for the degree of Master of Science (Speech and Hearing) of the student **(Register No.MSHM0110).**

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Certificate

This is to certify that this dissertation entitled **"A COMPARATIVE STUDY OF LEXICAL TRAINING IN NORMALS AND APHASICS"** has been prepared under my supervision and guidance. It is also certified that this has not been submitted earlier in any other University for the award of any diploma or degree.

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Declaration

This dissertation entitled **"A COMPARATIVE STUDY OF LEXICAL TRAINING IN NORMALS AND APHASICS"** is the result of my own study under the guidance of Dr. Shyamala K.C, Reader, Department of Speech and Language Pathology, All India Institute of Speech and Hearing, Mysore and has not been submitted in any other University for the award of any degree or diploma.

Mysore,
June, 2003 **Reg. No. MSHM0110**

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Introduction

When we speak, word retrieval is usually a quick and easy process albeit some word- finding difficulties that may occur even in normal speakers. At times, proper names or precise words may in fact be difficult to retrieve even if we know them. In aphasic patients difficulty in word retrieval is the most pervasive symptom of language breakdown and naming disorders may result in a wide variety of errors due to damage to different stages in the process of naming. The similarities between aphasic errors and normal slips of the tongue have been noted by many authors. Freud 1953 (as cited in Basso, Marangolo, Piras, & Galluzzi, 2001) claimed that "the paraphasia in aphasic patients does not differ from the incorrect use and distortion of words which the healthy person can observe in himself in states of fatigue or divided attention".

Naming impairments are an ubiquitous feature of aphasic disorders (e.g., Kohn and Goodglass, 1985; Lecours and Lhermitte, 1979; Williams and Canter, 1982 as cited in Miceli, Giustolisi, & Caramazza, 1991). The cause of these impairments varies, however. Excluding those cases that result from failure of input (perceptual) processing mechanisms, naming impairments may result from damage to the semantic processing component or the phonological (or orthographic) output lexicons. Impairments that result from selective damage to the semantic component are clearly distinguishable from those that result from selective damage to the output lexicons: the former, but not the latter, necessarily co-occur with lexical comprehension impairments of comparable magnitude; and, the latter, but not the former, allow a dissociation between oral and written naming (Caramazza and Hillis, 1990; Hillis et al., 1990; Kay and Ellis, 1987).

A review of published approaches to treating aphasic naming problems indicates that the choice of therapy method is greatly influenced by the profession and training of the person doing the research. For example, Stewart (1966) was a speech therapist working in a school system where drills often are used successfully with developmental articulation problems. So, when asked to treat an aphasic adult, she may have turned to simple naming drills without further consideration. In contrast, clinicians whose experience emphasized the neurological foundations for language have based their treatments on theories of functional brain mechanisms. Examples of these more neurological methods are the functional reorganization approach of Luria (1970) and the closely allied deblocking approach of Weigel (1968). Clinical researchers with training in neurolinguistic and cognitive psychology tend to base their aphasia treatment approaches on cognitive models of normal language, for example, Howard, Patterson, Franklin, Orchard-Lisle, and Morton (1985) described their naming therapy in terms of the "logogen" model of semantic selection proposed by Morton (1969). In fact, most current approaches to treatment of aphasic naming disorders can be grouped under these two headings: functional reorganization and deblocking methods, and cognitive-model-driven approaches.

Review of Literature

There is increasing concern that therapies for communication disorders be evaluated. In the area of aphasia therapy there are encouraging signs of progress. In contrast with earlier studies, which examined the broad effects of a variety of therapies, often improperly defined, on a heterogeneous sample of aphasic patients, recent studies have used single or small number of patients with a particular problem for which a specific treatment is to be evaluated (e.g. Jones 1986, De Partz 1986, Byng 1988, and Coltheart 1986 as cited in Marshall, Pound, White-Thompson, & Pring, 1990). The scale of these studies make them much more accessible to the practising clinician. Any patient may become the subject of an efficacy study, which may occur within the course of normal clinical practice (Pring 1986).

This change in the style of efficacy research follows similar changes in theoretical research. Ten years ago this followed a predictable course. Patients were placed in categories that they had occupied for a century or so. Research compared the categories, and differences found supported the classification while concealing potentially important individual variation between patients consigned to the same category. Now there are no shortages of theoretical opinions favoring the abandonment of any form of classification (Ellis 1987, Caramazza and McCloskey, 1988). In essence this demonstrates that patients are as alike as assessments will allow them to be. As these are refined and deficits more minutely examined, similarities between patients diminish rapidly. Theoreticians have learnt what clinicians always knew: that no patients are really the same. As a result, single case studies have assumed new importance in theoretically motivated research and this enthusiasm is spilling over into efficacy research. There is room for a little pragmatism here, however. Patients may all be different but some are more different than others. Small group studies of patients with a common disability (even in the context of other dissimilar disabilities) offer the advantage of cautious generalization to other patients that single case studies do not permit (Marshall, Pound, White-Thompson, & Pring, 1990).

Although single case studies offer greater accessibility to efficacy research, they do not diminish the demands of experimental methodology. As in any experiment, alternative explanations of change in performance must be controlled for. Improvement must be shown to be due to the specific effects of the therapy and must not be accounted for either by naturally occurring recovery of function or by more general benefits of receiving therapy; moreover, it should be shown to persist over time and, if possible, to assist the patient's communication in situations outside the clinic. In addition, there is the problem that linguistic performance is difficult to assess and particularly difficult to render into meaningful numbers for the sake of statistical analysis.

It is not surprising, therefore, that therapy research has best developed in areas where these problems are minimized. Anomia is one such area. It is a prominent feature of the difficulties experienced by many patients. Although it occurs in conjunction with a variety of other problems it may show sufficient similarity across patients to persuade us that the same forms of therapy may be beneficial to many of them. That immediate difficulties may often be overcome by presenting a phonemic cue and/or by giving extra semantic information is a beguilingly simple indication of the procedures that might be used in therapy, though optimism needs to tempered by the persistency that word-finding difficulties often show. Anomia is quite apparent in spontaneous speech but its assessment therein is not straightforward. The use of confrontation naming, although an artificial task, appears to tap similar skills (Hadar, Jones and Mate-Kole 1987) and has the advantage of giving a simple numerical representation of performance.

The pervasiveness of word-finding difficulties has motivated several studies devoted to the management of the deficit and its effectiveness. Group studies suggest that word-finding deficits in general can be ameliorated (Hillis, 1989; Howard, Patterson, Franklin, Orchard - Lisle, and Morton, 1985a, 1985 b; Marshall, Pound, White- Thompson, and Pring, 1990; Myers-Pease and Good glass, 1978) but in group studies it is difficult to evince what treatment has been useful for what type of patients. Error types in normal subjects and aphasic patients have provided important clues to the architecture of the normal lexical processing system and many authors have recently proposed relying on cognitive neuropsychological models to reach a functional diagnosis, which should then be used as a guide to aphasia therapy (Behrmann, 1987; Byng, 1988; Hillis and Caramazza, 1987). Theoretically based treatments have been published presenting cases of patients whose deficits were identified relative to a functional model of single word processing and rehabilitated following the cognitive neuropsychological approach (Howard et al., 1985b; Miceli, Amitrano, Capasso, and Caramazza, 1996).

For the present study the background model referred has the functional architecture shown in Fig. 1. Briefly, the model assumes that written language does not depend on spoken language and makes a distinction between input and output word-form stores. The single semantic component is independently connected with the phonological and the orthographic input and output lexicons, which contain the phonological and the orthographic representations of words. The segmental processing of new words in reading aloud is based on grapheme-to-phoneme conversion rules, and in writing to dictation on phoneme-to-grapheme conversion rules; the segmental processing in repetition is based on input to output phoneme conversion rules that are not represented in Fig. 1. Repetition, writing, and reading aloud of regular words can be performed by the dual activation of the lexical and the sub-lexical procedures. Finally, it is assumed that the lexical and sub-lexical procedures interact.

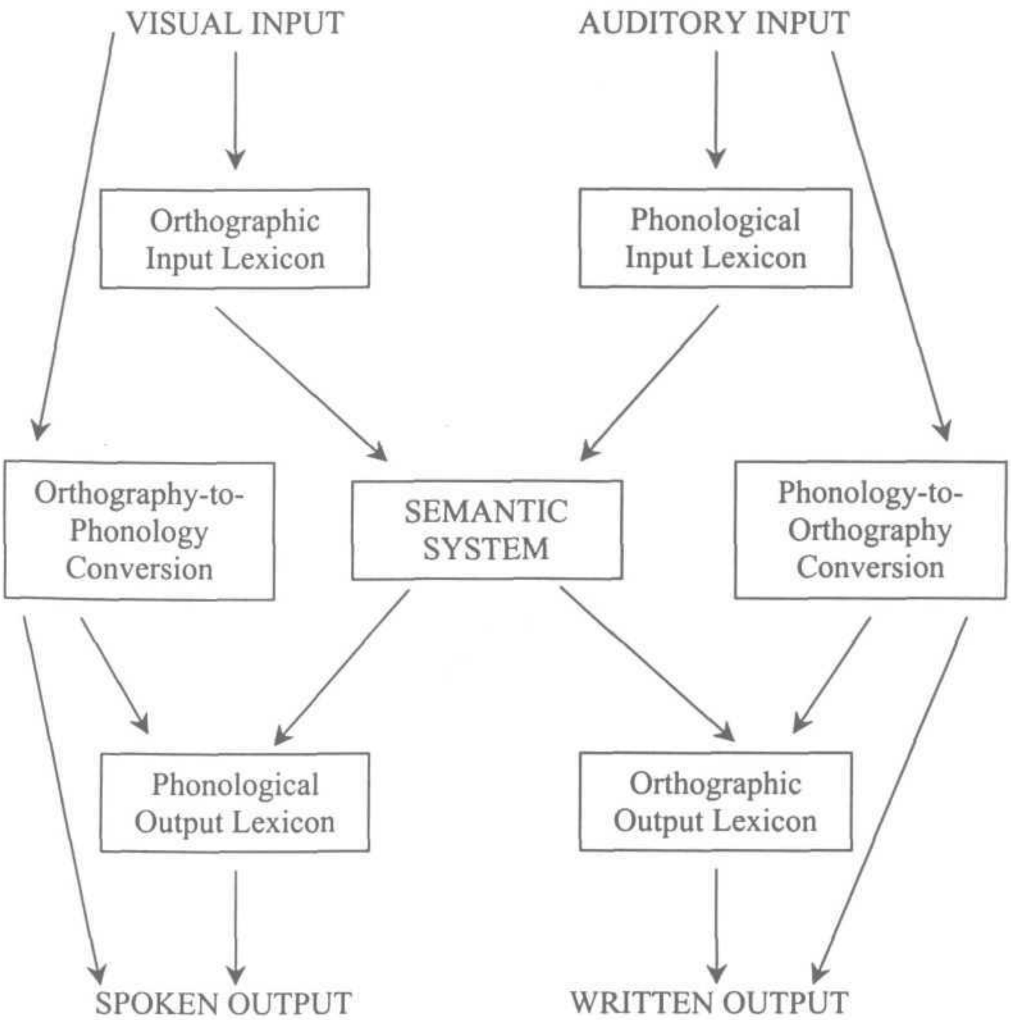


Fig. 1 : Functional architecture of the lexical-semantic system and the sublexical-conversion mechanisms.

This model predicts different error types in a naming task according to the site of the functional damage. In the present study, damage to the phonological output lexicon is of significant interest and focus is on patients with a loss of information about the phonological representations and intact verbal semantics. In these patients, it is assumed that the complete semantic information fails to activate an unavailable (or inaccessible) lexical representation and patients produce either omissions, descriptions of the object to be named (circumlocutions), or partial phonological renditions of the target word. It has also been argued that semantic paraphasias can result from damage to the output lexicon (Caramazza and Hillis, 1990). Two sorts of difficulty might cause naming problems in this area of the model. Patients might access the semantic system adequately but be unable to access the appropriate phonology. Such a patient might produce an omission or circumlocution but probably not a semantic error that they would know to be incorrect. Alternatively patients might have a 'semantic deficit'. This would occur when the general but not the specific semantics of the pictured item are accessed resulting in several related words being partially activated at the phonological stage. The patient has sufficient information to comprehend partially the word, to circumlocute or gesture in a way that demonstrates this, but naming may produce semantic errors.

In the latter group the difficulty should be apparent in tasks that require a semantic decision without a spoken response. Several studies have demonstrated this. Typically, semantic discrimination tasks in which a spoken word must be matched against a picture presented among semantically related foils are used. Gainotti (1976) tested a large random sample of aphasics and found semantic errors in naming to be strongly associated with those in auditory comprehension. In a second study Gainotti, Miceli, Caltagirone, Silveri, and Masullo (1981) divided patients according to their predominant form of naming errors. Semantic confusions on input tasks were related to semantic, anomic and neologistic naming errors but not to phonetic or phonemic transformations. Butterworth, Howard, and McLoughlin 1984 (as cited in Marshall, Pound, White-Thompson, & Pring, 1990) found semantic impairment on comprehension tasks to be significantly related to semantic though not neologistic naming errors. They also found the relationship to be independent of the type of aphasia exhibited by the patient (in contrast with the view that semantic errors are a feature of fluent aphasia) and that there was no one-to-one correspondence between errors on the two tasks. The last finding is important since it indicates that the problems arise from a generalized difficulty to specify the correct semantics of a word rather than the loss of semantic descriptions for particular words (Gainotti 1987).

Gainotti, Silveri, Villa, and Miceli (1986) divided 13 patients into a group of eight who showed a deficit on semantic discrimination tasks and five who did not. The group with lexical semantic impairment made significantly more semantic errors in naming, whereas the group without lexical semantic impairment made significantly more omissions (though some semantic errors occurred as well). Evidence was also presented that those patients without a comprehension difficulty had greater implicit knowledge of the word they were trying to retrieve. They were more likely to identify the first letter correctly and benefited more from phonemic cueing, though, in neither case, significantly.

The latter parts of these results are somewhat confusing. If patients without a semantic deficit have targeted a specific phonology, one could anticipate that partial phonological knowledge might be available when naming itself fails. It is unclear, therefore, why the first sound should offer much assistance to them. In contrast, patients with a semantic deficit who make semantically related responses appear to be undecided between different target phonologies and a phonological cue might be expected to assist them. Examination of the individual patients in Gainotti et al. reveals a high level of variability among patients of both kinds though there clearly are patients in the semantic deficit group who do not benefit from cues.

A globally aphasic patient, JCU, reported by Howard and Orchard-Lisle (1984) is relevant here. She is not reported to make semantic errors in naming but her performance is so poor as to give little opportunity for this. Nevertheless, she is much aided by phonological cues and produces semantic errors when an inappropriate cue is given. It would appear that JCU is partially activating several related phonologies; the cue enables one of these to prevail resulting in either correct naming or semantic errors. JCU has a semantic deficit; when asked to match a written or spoken word to a picture she failed when foils were from the same category. She fits the picture drawn above but not the trend of Gainotti et al.'s data; her semantic deficit leaves her unsure which the appropriate phonology is and, consequently, cues assist her.

EST, a patient reported by Kay and Ellis (1987) is an anomic without a semantic deficit. EST did not make semantic errors in naming nor could he be induced to do so by inappropriate cues. His naming was related to frequency; he named many high-frequency pictures, those of intermediate frequency gave errors with phonological similarities to the target and were assisted by phonological cues and, lowest-frequency words were rarely named. EST succeeded on all the single-word comprehension tasks administered except those involving abstract concepts; thus for the pictures used in the naming tasks there was no evidence of a semantic deficit. Contrasting EST with JCU, Kay and Ellis suggest that patients with semantic deficit will fail on comprehension tasks that require precise semantic knowledge, will benefit from phonemic cues but also show miscuing effects and will not experience tip of the tongue effects. Patients with a phonologically based anomia will show the reverse effects.

These studies support a dichotomy between forms of anomia that do and do not compromise lexical semantics. As with many dissociations, however, it is probably wiser to expect that patients will present with differing degree of both problems and only rarely as pure case of either.

Therapy Studies

Studies of the treatment of word-finding difficulties are well represented in the literature. Small group studies of treatment effects using broadly similar patients have been the chosen methodology.

As previously stated, clinical experience suggests that phonemic cues or the provision of semantic information aid immediate naming. Whether either method has longer-term benefits and whether generalization to untreated items occurs are less clear. These are important for estimating the clinical potency of the methods and the latter also influences choice of experimental methodology. Most studies have assumed that untreated items will improve little and may act as controls. Following from the above, studies have examined the effects of either phonological or semantic assistance. The general impression that semantic methods are superior has influenced the present studies. The evidence is not entirely unequivocal on this, however.

Formal investigation of the immediate effects of cues was undertaken by Myers-Pease and Goodglass (1978). Twenty patients with naming difficulties from differing diagnostic groups were tested (analysis by group showed significant differences in severity in the order Wernicke's > Broca's > anomics). Six different cues were used. Phonological cues were either first sounds or rhymes, semantic were superordinate, function or location cues and finally sentence completion cues were also used. First sound cues were significantly more effective than all others and sentence completion was significantly better than the three semantic cues. The more severe patients (mainly Wernicke's) benefited least and only from first sound cues. Milder patients benefited more and from all forms of cues.

In contrast are the findings of Patterson, Purell and Morton (1983) who used first sound cues and repetition of picture names prior to naming. While confirming the immediate benefits of the phonological cue, no benefits were found beyond the immediate cuing situation. Howard, Patterson, Franklin, Orchard - Lisle and Morton (1985a) confirmed the brief effectiveness of phonological cuing (Experiment 4). Using repetition, a rhyming as cue or a rhyme judgment involving the picture name, no benefit over controls was found 15 or 30 min after cueing.

Various forms of semantic activity, though less successful in immediately eliciting the picture name, appear to have greater success as longer-term facilitators of its retrieval. Howard et al. (1985a) tested this in three experiments. In the first, patients were asked to indicate which of five assorted pictures matched a spoken word. Naming was better than that of controls 20 min later. The second repeated the procedure with sets of pictures from the same semantic category as the target. Benefits were obtained 24 hr afterwards. By comparison a condition in which a spoken word and picture associated with the target were matched gave no advantage over controls. A third experiment confirmed these results for a written word to picture matching task and for a condition in which patients answered questions about the picture. Both gave significant results 20 min later. At a later test after 2 weeks, treated items appeared to have declined only a little but were no longer significantly better than untreated items which showed some improvement.

These results suggest that tasks, which require access to the semantic system, may benefit subsequent naming. By comparison, phonological cues that may be assumed to operate by activating entries in the phonological output lexicon appear to have immediate but little lasting benefit.

Although these results have important consequences for therapy, a further qualification might be made. Experiments of this kind evaluate the methods therapy might use rather than therapy itself. The results follow a single, highly structured session whereas therapy in clinical settings is more prolonged and less structured. It is possible that using a mixture of techniques may be more effective though some are individually less beneficial than others. Reports of the use of more varied techniques over longer periods of time have had encouraging results. Wiegel-Crump and Koenigsknecht (1973) used pictures from five categories employing repetitive presentation in different modalities as suggested by Schuell, Jenkins and Jimenez-Pabon (1969). Four patients were treated for 18 1-hr sessions over a 6 to 9 week period. Improvement was found on items drilled in therapy, on undrilled items from the same category and on items in an untreated category. This appears to be a most positive result, therefore, indicating generalization of benefits to untreated items both within and without the categories used. It poses a problem in experimental design, however, since improvement is sufficiently extensive to have affected the untreated group, which were a potential control. Since the patients were a minimum of 3 months post-onset and had little previous therapy, a possible if uncharitable explanation might be that improvement owed something to spontaneous recovery and to general rather than specific effects of therapy.

The results of these studies differ between those in which a single brief intervention is used and those where repeated interventions and, consequently, a closer approximation to therapy are used. In the former, only semantic cues have lasting effects though their duration is in some doubt. In the latter, the effects of both phonological and semantic interventions were apparent up to a week later with the suggestion that generalization may be greater when semantic tasks are used. It remains unclear whether this difference is due to the repetition of treatment sessions, the variety of the interventions or whether the overall improvement disguises differing merits in the component therapies.

Need for the study

The cognitive approach allows us to reach a precise functional diagnosis but it does not provide guidelines for the implementation of rehabilitation (for a discussion, see Caramazza, 1989). In fact the models fail to include many important aspects of the rehabilitation process, such as treatment techniques likely to modify the identified functional damage/s.

To build a theory of rehabilitation, the hypothesis at the basis of the proposed intervention must clearly be made explicit and the proposed intervention should then be tested. It is opined that, short of counterevidence about its lack of effectiveness, therapy should be directly aimed at the functional damage. It is further argued that with some obvious limitations (such as those due to the general effect of the presence of brain damage, which obviously plays an important role), a comparison can be made between a normal subject performing a given task and a brain-damaged patient performing the same task. If this is the case, the techniques most successful in normal subjects for solving a given task can be used as a starting point for implementing a therapeutic method for patients with a functional damage, which impairs the execution of the same task.

Aim of the study

This study aimed to identify the technique (from among the chosen three) that is most successful in normal subjects' learning of new words for its implied effectiveness in the remediation of anomia.

Rationale

When asked to learn words in an unknown second language or non-words associated with a given picture, normal subjects have complete semantic information about the concept. They cannot, however, activate the word in the output lexicon because, by definition, the phonological representation of the word is not there. Aphasic patients with an intact semantic component and damage to the phonological output lexicon would be in the same situation (except, as pointed out earlier, for the consequences of brain damage that obviously play a role). If such a technique can be identified, the following rational step would be to see whether it is successful with patients with the same functional "damage" of normal subjects, namely damage to the phonological output lexicon with an intact semantic system. Tikofsky and coworkers (Tikofsky, 1971; Carson, Carson & Tikofsky, 1968) have in fact reported data that indicate that relative to normal controls, aphasic patients as a group show reduced rates and amounts of verbal learning but that their performance patterns are quite similar.

Method

Totally thirty-four subjects participated in this study of lexical training.

Normal Subjects

Thirty healthy right-handed adults (15 males and 15 females) participated in the study. All the subjects were English speaking aged between 18 and 30 years with 14-15 years of formal education. Subjects were randomly subdivided into three groups (10 subjects in each group) matched for age and educational level.

Stimuli

A set of 60 bisyllabic-invented words (adapted from Basso, Marangolo, Piras, & Galluzzi, 2001) was used. Words were construed in such a way as to have a low level of similarity with English words, to include a consonant cluster, and to have a one-to-one phoneme-to-grapheme correspondence. Thirty words were used for learning (experimental) and 30 as controls. Sixty pictures of low, medium, and high familiarity, belonging to different semantic categories from the Snodgrass and Vanderwart's (1980) picture-set, were selected. The sixty pictures were randomly matched to the invented words, one picture per word, with the same number of low, medium, and high familiarity pictures in the experimental and control group (see appendix for the list of words).

Procedure

Subjects were tested individually. The experiment included three phases: a training phase, a learning phase, and a follow-up. The first two phases were run on two consecutive days, and the third a week later.

Training.

The procedure for the training phase was identical for the three learning methods and was as follows: the sixty pictures were presented one by one to the subject in pseudorandom order while the examiner clearly said the corresponding invented words. The subject was instructed to pay attention to each word-picture pair without repeating the word aloud. The pictures were presented three times and at the end of third presentation, the subject was presented with a display of the 60 pictures and was required to point to the picture named by the examiner. If he or she pointed to an incorrect picture, the examiner pointed to the correct one saying the corresponding word and then went on to the subsequent stimulus.

On the second day, the subject was first presented once again with a display of the 60 pictures, and was required to point to the picture named by the examiner. If the subject pointed to an incorrect picture, the examiner did not comment on the error in any way and said the subsequent word. The 60 pictures were then presented one by one to the subject and he or she was asked to name them without any feedback; the number of correct responses was recorded (baseline).

Learning

The learning phase followed immediately and was different for the three experimental groups. In the learning phase and in the subsequent naming condition the pictures were presented in pseudorandom order. For each group of subjects a different cueing method was used. The first group was asked to learn the words by repeating aloud the experimental stimulus presented by the examiner together with the corresponding picture. The examiner showed the pictures one by one and waited three seconds for the subject to say the corresponding word. If he or she failed, the examiner said the word and the subject was required to repeat it. After presentation of the 30 experimental pictures, the subject was presented with all the pictures (30 experimental and 30 control pictures) and asked to say the "name" of each picture. The number of correct experimental and control words was recorded. The whole naming procedure was then repeated until the subject correctly named all 30 experimental words.

Subjects in the second group were asked to learn the words by reading aloud the written word presented with the corresponding picture. The procedure was the same as for the repetition group.

The third group was asked to learn the words using an orthographic cue. The examiner presented the pictures one by one and asked the subject to say the name; if he or she could not say it in three seconds, the examiner wrote the first letter of the corresponding word and waited 3 sec for the subject to complete the word. If he or she could not, the same procedure was used for the following letters until the subject completed the written word and said it. The procedure was then the same as for the reading aloud and repetition groups.

Follow-up

A week later and without previous notice, the subjects were once again presented with the 60 pictures one by one and asked to name them without any feedback.

Aphasic Patients

Subjects

Four aphasics, 2 Broca's and 2 Anomics based on their performance on Western Aphasia Battery (Kertesz and Poole, 1974) were taken as subjects.

Procedure

Two hundred pictures of different semantic categories were selected; frequency varied from low to high. The pictures were presented once to the patients for three consecutive days, and the examiner waited 5 sec for the response. The pictures the patients could not name and for which they always produced an omission were selected. The selected pictures were then presented three times for comprehension. They were presented once the with the correct name, once with a semantic alternative and once with an unrelated name (for table, for instance, they were told once table, once writing desk, and once car); the patient had to say whether the name was correct or not. Only the pictures for which the patients' answers were always correct were chosen for the experimental naming therapy.

Therapy

The selected pictures were subdivided in four subgroups of 25 pictures each, controlled for frequency of use. Three groups were used for the three learning methods and one as a control. The same control pictures were used for all therapy programs, which were performed on three subsequent weeks. For all the four patients the order of presentation was random. Before starting therapy, the patients were presented with the control pictures and the group of pictures for the naming program to be started (baseline). The treatment was the same as for the control subjects with two differences. In the orthographic cueing method, the examiner waited 5 sec (and not 3 sec) before adding another letter to the preceding ones, and for all three methods the procedure was repeated three times a day for 5 consecutive days.

Follow-up

At follow-up performed independently for each therapy program, the patients were asked to name the pictures of the control and the pictures belonging to the last program performed.

Analysis

The data for both the groups (normals and aphasics) were tabulated and statistically analyzed using ANOVA and Duncan's test with respect to scores obtained for three different methods of learning.

Results

NORMAL SUBJECTS

Table 1 reports for each of the 10 subjects of the repetition group the number of experimental and control pictures correctly named at the baseline, the number of presentations necessary to learn the 30 experimental words, and the number of experimental and control pictures correctly named at the follow-up. Tables 2 and 3 report the same data for reading aloud and the orthographic cueing group, respectively.

Table 1: Scores for repetition method for experimental (Exp.) and control (Contr.) stimuli

Subjects	Baseline (stimuli)		No. of Presentations	Follow-up (stimuli)	
	Exp	Contr		Exp	Contr
A	6	3	6	10	2
B	4	4	6	6	2
C	7	3	5	6	3
D	5	2	7	7	4
E	6	5	8	12	0
F	6	4	7	10	1
G	5	3	6	8	3
H	3	2	6	15	2
I	3	3	9	5	2
J	4	4	8	12	1

Number of stimuli (experimental and control) correctly named by the subjects at baseline and follow-up, and number of presentations necessary to learn the 30 experimental words are given in table 1 for repetition method.

Table 2: Scores for reading aloud method for experimental (Exp.) and control (Contr.) stimuli.

Subjects	Baseline (stimuli)		No. of Presentations	Follow-up (stimuli)	
	Exp	Contr		Exp	Contr
K	5	2	6	10	0
L	2	3	9	9	2
M	1	3	7	11	2
N	3	1	7	7	1
0	6	1	7	13	1
P	3	2	6	8	3
Q	3	2	8	7	2
R	5	0	6	7	2
S	6	0	8	12	3
T	4	2	7	6	0

Number of stimuli (experimental and control) correctly named by the subjects at baseline and follow-up, and number of presentations necessary to learn the 30 experimental words are given in table 2 for reading aloud method.

Table 3: Scores for orthographic cueing method for experimental (Exp.) and control (Contr.) stimuli

Subjects	Baseline (stimuli)		No. of Presentations	Follow-up (stimuli)	
	Exp	Contr		Exp	Contr
U	6	3	4	20	2
V	5	2	4	15	2
W	4	1	5	12	2
X	3	3	6	12	1
Y	2	4	5	19	3
Z	3	3	6	17	3
Al	2	2	6	18	1
A2	4	3	4	23	2
A3	5	1	4	21	2
A4	4	2	4	19	1

Number of stimuli (experimental and control) correctly named by the subjects at baseline and follow-up, and number of presentations necessary to learn the 30 experimental words are given in table 3 for orthographic cueing method.

Number of presentations to criterion

For each subject in each experimental group the number of presentations necessary to learn the 30 experimental words was computed and the results of the three groups were compared. The data were analyzed using an ANOVA with one within-subject factor (cueing method: repetition, reading aloud, orthographic cue). The analysis revealed a significant difference between the three cueing methods: F= 13.560, df 2, p= .000. The mean number of presentations in learning the 30 experimental words with the orthographic cue was significantly lower (4.8) than the number of presentations in learning the experimental words with the repetition (6.8) or the reading aloud method (7.0) (Duncan's test: p<. 01). The repetition and the reading aloud methods did not differ from each other (Duncan's test: not significant).

Number of experimental words correctly remembered at the follow-up.

For each subject in each experimental group, the number of experimental and control pictures correctly named at the baseline and follow-up was computed. The data (mean and SD) as depicted in Table A were further analyzed with an ANOVA with one within-subject factor (cueing method: repetition, reading aloud, orthographic cue) and two between-subject factors (time, baseline vs. follow-up; number of pictures, experimental vs. control).

Table A: Comparison of scores obtained for three learning methods

Cueing method							
Stimuli	**Time**	**Orthographic**		**Repetition**		**Reading aloud**	
		Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
Exp	Bsln	4.10	1.1972	4.9	1.37	3.8	1.6895
	Fu	17.60	3.6576	10.10	3.3813	9.00	2.3587
	Total	10.85	7.4146	7.5	3.6635	6.4	3.3228
Contr	Bsln	2.4	.9661	3.30	.9487	1.6	1.0357
	Fu	1.9	.7379	2.00	1.11547	1.6	1.0357
	Total	2.15	.8751	2.65	1.2258	1.6	1.0108
Total	Bsln	3.25	1.3717	4.10	1.4105	2.7	1.7364
	Fu	9.75	8.4534	6.05	4.8284	5.3	4.1247
	Total	6.5	6.8238	5.075	3.6472	4.00	3.3909

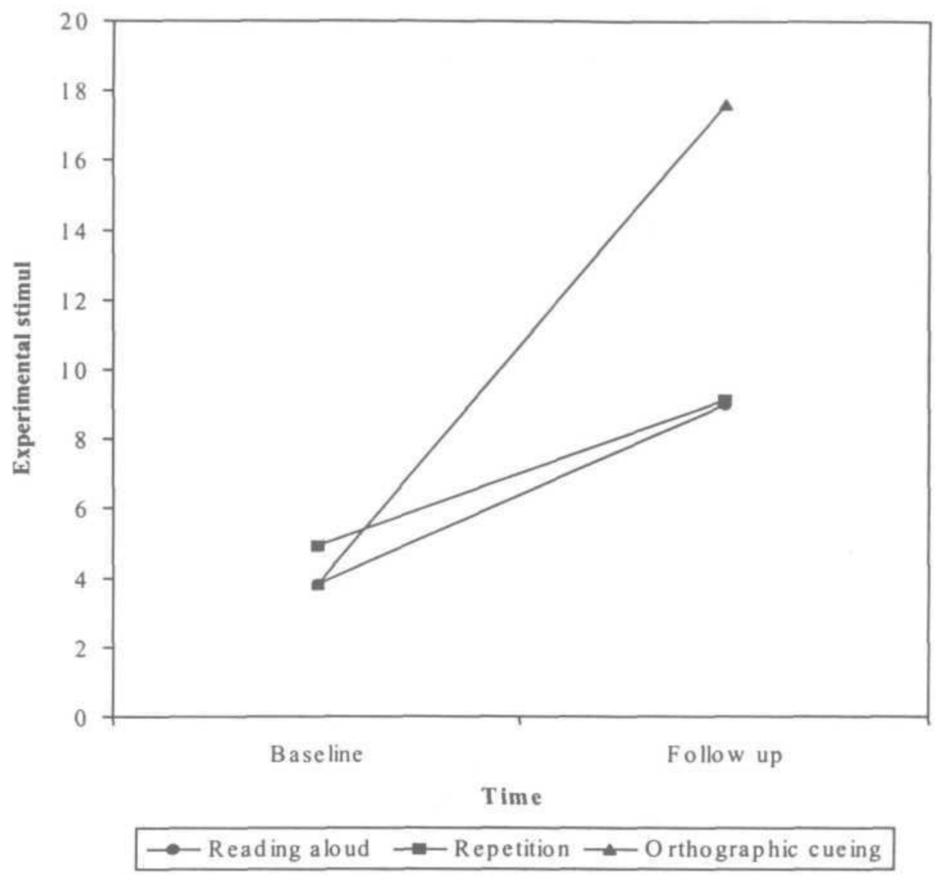
Note: Exp., experimental; Contr., control; Bsln., baseline; Fu., follow-up

Results showed three significant main effects: method ($F= 20.452$, df 2, $p= .000$), time ($F= 119.683$, df 1, $p= .000$), and number of pictures ($F= 326.350$, df 1, $p= .000$).

The two-way interactions were also significant: cueing method x time ($F= 17.489$, df 2, $p= .000$), cueing method x number of pictures ($F= 15.024$, df 2, $p= .000$), and time x number of pictures ($F= 161.888$, df 1, $p= .000$). Finally, there was a significant three-way interaction: cueing method x number of pictures x time ($F= 16.549$, df2,$p=.000$).

The mean number of experimental pictures correctly named with the orthographic cue at follow-up (17.6) was significantly higher than that with the repetition (10.1) and the reading aloud method (9.0). The same has been depicted in the graph 1 below.

Graph 1: Graphical representation of trends in learning of experimental stimuli using three methods.



APHASICS

Table 4 shows, for each method, the number of pictures (experimental and control) correctly named by the aphasic group during the baseline condition, at the end of treatment (day V), after 1 (follow-up 1) and 2 weeks (follow-up 2) conditions, with each learning method.

Table 4: Scores obtained for each learning method at different time intervals for experimental (Exp.) and control (Contr.) stimuli

Aphasic -1

Methods	Baseline		Fifth day		Follow-up 1		Follow-up 2	
	Exp	Contr	Exp	Contr	Exp	Contr	Exp	Contr
Orthographic	3	2	18	3	15	2	13	2
Repetition	5	3	10	4	7	4	5	3
Reading aloud	4	3	11	3	7	3	5	3

Aphasic -2

Methods	Baseline		Fifth day		Follow-up 1		Follow-up 2	
	Exp	Contr	Exp	Contr	Exp	Contr	Exp	Contr
Orthographic	2	1	17	3	15	2	14	2
Repetition	3	3	10	3	8	3	6	2
Reading aloud	3	2	14	2	10	2	7	2

Aphasic -3

Methods	Baseline		Fifth day		Follow-up 1		Follow-up 2	
	Exp	Contr	Exp	Contr	Exp	Contr	Exp	Contr
Orthographic	4	3	20	5	17	4	13	3
Repetition	3	3	12	4	10	4	8	3
Reading aloud	2	3	15	4	7	3	6	4

Aphasic -4

Methods	Baseline		Fifth day		Follow-up 1		Follow-up 2	
	Exp	Contr	Exp	Contr	Exp	Contr	Exp	Contr
Orthographic	4	2	22	2	20	3	17	3
Repetition	4	5	18	4	14	2	9	2
Reading aloud	3	3	18	4	11	2	7	4

Number of experimental words correctly remembered at the follow-up

For each subject in each experimental group, the number of experimental and control pictures correctly named at the baseline and follow-up was computed. The data (mean and SD) as depicted in Table B were further analyzed with an ANOVA with one within-subject factor (cueing method: repetition, reading aloud, orthographic cue) and two between-subject factors (time, baseline vs. follow-up; number of pictures, experimental vs. control).

Table B: Comparison of scores obtained for three learning methods

Cueing method							
Stimuli	**Time**	**Orthographic**		**Repetition**		**Reading aloud**	
		Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
Exp	Bsln	3.25	.9574	3.5	.5774	3.25	1.258
	Day V	19.25	2.2174	12.5	3.785	14.5	2.8868
	Fu 1	16.75	2.3629	9.75	3.0957	8.75	2.0616
	Fu 2	14.25	1.8930	7.0	1.8257	6.25	.9574
	Total	13.37	6.5409	8.187	4.1668	8.187	4.6075
Contr	Bsln	2.00	.8165	3.5	1.00	2.75	.5000
	DayV	3.25	1.2583	3.75	.500	3.25	.9574
	Fu 1	2.75	.9574	3.25	.9574	2.50	.5774
	Fu2	2.50	.5774	2.5	.5774	3.25	.9574
	Total	2.625	9574	3.25	.8563	2.9375	.7719
Total	Bsln	2.625	1.0607	3.5	.7559	3.00	.9258
	DayV	11.25	8.7137	8.12	5.3033	8.875	6.3344
	Fu 1	9.75	7.6672	6.5	4.0708	5.625	3.6228
	Fu 2	8.375	6.4129	4.75	2.7124	4.75	1.8323
	Total	8.000	7.1392	5.718	3.8791	5.562	4.2040

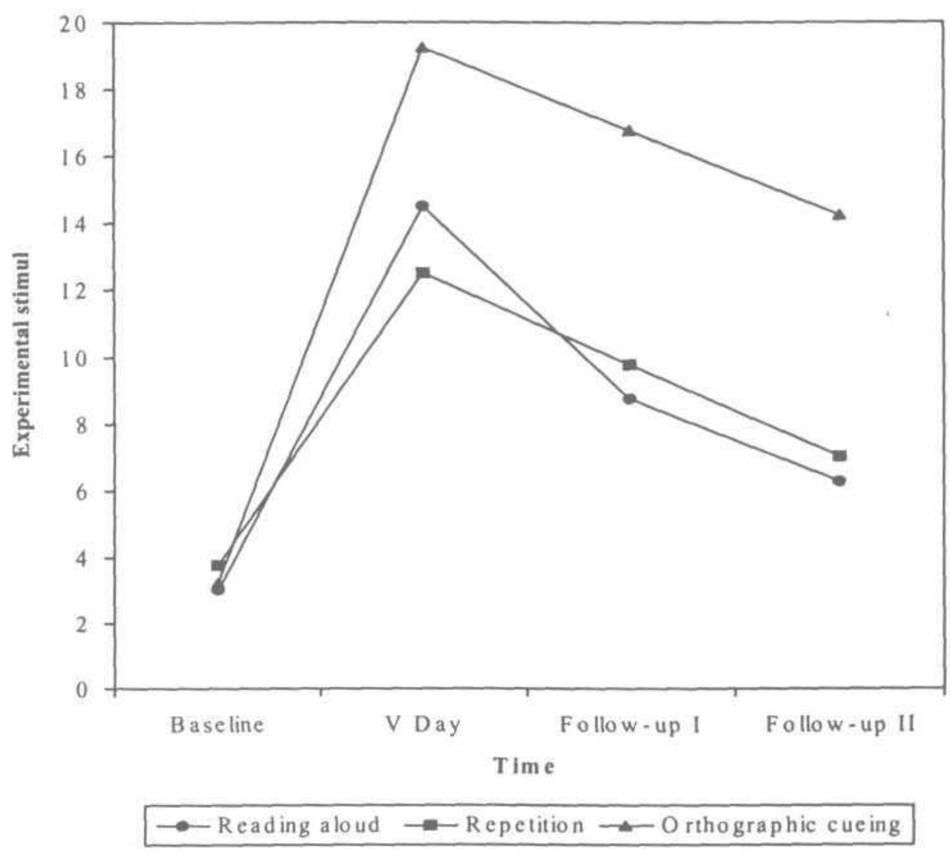
Note. Exp., experimental; Contr., control; Bsln., baseline; Fu., follow-up.

Results showed three significant main effects: method (F=21.636, df 2, p= .000), time (F=62.077, df 3, p= .000), and number of pictures (F=424.559, df 1, p= .000).

The two-way interactions were also significant: cueing method **x** time ($F= 4.369$, df 6, $p= .001$), cueing method **x** number of pictures ($F=31.055$, df 2, $p= .000$), and time **x** number of pictures ($F=50.980$, df 3, $p= .000$). Finally, there was also a significant three-way interaction: cueing method x number of pictures **x** time ($F=3.025$, df 6, $p=.011$).

The mean number of experimental pictures correctly named with the orthographic cue on fifth day (19.25), follow-up 1 (16.25) and follow-up 2 (14.25) was significantly higher than that with the repetition: fifth day (12.5), follow-up 1 (9.75), follow-up 2 (7.0) and reading aloud method: fifth day (14.5), follow-up 1 (8.75), follow-up 2 (6.25). The same has been depicted in the graph 2 below.

Graph 2: Graphical representation of trends in learning of experimental stimuli using three methods.



Discussion

The present study aimed at training for learning of new 'words' by normal subjects using three different methods that are usually used in aphasia therapy for remediation of naming disturbances. On an analysis of results, all the control subjects reached criterion with the three learning methods (not unexpectedly) and retained some learning at follow-up. The use of the orthographic cue was found to be significantly more successful with regards both to the number of presentations necessary to reach criterion (which was lower for the orthographic method than for the other two methods) and to the number of "words" remembered at follow-up, a week later (which was higher for the orthographic method than for the other two methods). The other two methods did not differ.

Results were similar for the aphasic patients too. Some learning was possible with all three methods but the patients did not learn all the experimental words. In addition, all aphasics retained some learning at follow-ups, and this was significantly higher than baseline when words had been acquired with the orthographic cueing method.

What aspects of the orthographic cueing method and of the other two methods, reading aloud and repetition, can explain their different effectiveness in learning? In all three methods, as can be inferred from the functional architecture model of lexical-semantic system (cited from Hillis & Caramazza, 1991), the target is activation of the phonological representation in the output lexicon. The search for the correct response, however, seems to be more under intentional control in the case of the orthographic cueing method than in reading or repetition; in these cases the response is given to the subject and all he or she has to do is to transcode it from orthography to phonology in reading, and from input to output phonology in repetition.

In normal subjects, active participation in the learning process is known to produce better retention than passive observation. Also, the generation effect is the advantage in memory of self-produced as opposed to externally presented information although researchers do not agree on the possible explanations of the generation effect (Slamecka and Graf as cited in Basso, Marangolo, Piras, & Galluzzi, 2001). The various interpretations can be divided into two categories, those that implicate semantic memory explaining the effect as due to some more general principle of memory (such as depth of encoding, for instance) and those that attribute it to the intrinsic characteristics of the generation task (McElory and Slamecka as cited in Basso, Marangolo, Piras, & Galluzzi, 2001). Be it as it may, the important point here is that the generation effect has been proved sound. It has been found so in a wide variety of tasks as reported by many studies in the past, such as frequency judgments (Green, 1988 & Smith, 1996 as cited in Basso, Marangolo, Piras, & Galluzzi, 2001), procedural learning (Vakil, Hoffman, & Myzliek as cited in Basso, Marangolo, Piras, & Galluzzi, 2001), and acquisition of new words (Me Elroy and Slamecka, 1982).

Results of this study with normal control subjects confirm the effectiveness of generation over less effortful methods (reading and repetition) although other explanations (such as inherent tendency of subjects to rely on their idiosyncratic strategies for learning, role of memory) cannot be ruled out. An obvious difference between the three methods lies in the amount of time allowed for each response, which is longer in the orthographic cueing method. Since the orthographic cue remains in view of the subject, he or she has longer to search for the target word. The orthographic cue can be used to implement oral naming because the orthographic output can "recirculate" in the lexical system as assumed on the basis of background model of lexical semantic system. The written response can be converted by grapheme-to-phoneme conversion rules and produced orally. For aphasic patients time may be an important factor. It is argued that temporal absence of a phonological representation in the mother tongue or absence of phonological representation in a second language in normal controls can be compared to functional damage to the phonological output lexicon in aphasic patients and that the same learning strategies could be successful albeit less effective in aphasic patients because of a general loss of capacity to learn (Tikofsky, 1971; Carson et al., 1968). The effect of the three methods would be less but the orthographic cueing method, being the most effective one in normal controls, would still induce some learning.

Summary

This is an experimental study in which 30 normal controls and 4 aphasics (2 Broca's and 2 Anomics) were asked to learn new "words" associated with pictures. Three techniques that are normally used in aphasia therapy for the rehabilitation of anomia: reading aloud, repetition, and the use of an orthographic cue, were tested.

In order to study the efficacy of the three learning methods, three groups of normal subjects were asked to learn new 'words'; each associated with a picture, and compared the efficacy of the three methods. Also four aphasic patients with damage to the output lexicons as evident in their apparent inability to name were tested.

Orthographic cueing proved to be the best of the three learning methods tested in both the groups. Thus, aphasia therapy should be directed at the functional damage and that aphasic patients with specific functional damages can be compared to normal controls in special situations. Also strategies that work with normal subjects in such situations can also be successful with aphasic patients. This study therefore identified a highly effective learning method with normal subjects and verified its effectiveness with aphasic patients.

Keeping in mind the limitations of the present study such as methodological constraints e g., limited number of aphasics; the inherent tendency of normal subjects to rely on their own-individualistic strategies for learning; the role of memory and other cognitive factors in normals and aphasics' processing such as wholistic perception of stimuli (pictures as well as alphabets) and their inter/intra-subject differences, further research utilizing these factors is needed.

APPENDIX

Fam	Pictures	Invented words
M	Needle	Lasba
H	Shirt	Grole
L	Swan	Zaclo
H	Telephone	Nuspo
H	Book	Norli
H	Kitchen	Velba
M	Fish	Mible
H	Nose	Bippo
H	Glass	Vorpa
L	Goat	Pilca
L	Lion	Nunco
M	Pumpkin	Lansi
L	Harp	Cirli
L	Crown	Bepri
M	Orange	Pirga
M	Star	Lorba
L	Ostrich	Bleti
M	Celery	Lutre
H	Door	Fimpo
L	Caterpillar	Dresi
M	Arrow	Svife
H	Leg	Dongi
M	Padlock	Lepro
L	Kangaroo	Milvo
L	Giraffe	Svuna
L	Seal	Gilne
H	Trousers	Tucce
M	Ladder	Revra
L	Snail	Filco
H	Sock	Tiblo
H	Dress	Rundo
L	Snake	Galpo
M	Carrot	Silpo
M	Hat	Lecri
L	Mill	Gluve
L	Sheep	Lorfe
M	Pliers	Pasbi
L	Monkey	Clesi
H	Hanger	Tabri
L	Bear	Drelo
L	Anchor	Fitre
L	Mouse	Trulo

M	Cherry	Nirgo
H	Eye	Senci
M	Ball	Relga
M	Nail	Sdeta
H	Key	Sbulo
M	Saw	Lovri
H	Arm	Dippa
H	Finger	Zirve
H	Refrigerator	Zilci
H	Dog	Zunde
L	Leopard	Nipra
L	Barrel	Pruso
M	Watermelon	Nulge
M	File	Rembe
L	Loom	Dolce
H	Bed	Tepro
L	Beetle	Furra
H	Hair	Dunlo

Note : Fam, Familiarity; H, High ; M, Medium ; L, Low.

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